WE CLAIM:

1. A disk drive comprising:

(a) a disk comprising a plurality of tracks, wherein each track comprises a plurality of data sectors and a plurality of servo wedges;

(b) a head actuated over the disk;

(c) a spindle motor for rotating the disk at an operating speed in response to a spindle control current, the spindle motor comprising a plurality of windings which generate a back electromotive force (BEMF) voltage;

(d) a BEMF detector for generating a BEMF signal by comparing the BEMF voltage to a threshold; and

(e) a disk controller for:

measuring a BEMF speed error responsive to the BEMF signal during a BEMF spindle speed control mode;

updating the spindle control current in response to the BEMF speed error to drive the disk at the operating speed;

measuring a wedge-to-wedge time representing a time period between each servo wedge;

calibrating a reference time period representing an accumulation of a predetermined number of wedge-to-wedge times while the BEMF speed error is substantially zero;

switching to a wedge spindle speed control mode;

measuring a wedge time period representing an accumulation of a predetermined number of wedge-to-wedge times;

generating a wedge speed error representing a difference between the reference time period and the wedge time period; and

maintaining the disk at the operating speed by updating the spindle control current in response to the wedge speed error.

2. The disk drive as recited in claim 1, wherein the disk controller for:

(a) calibrating an at-speed current corresponding to a substantially zero wedge speed error; and

(b) detecting a time-out error condition if the spindle control current is not updated within a time-out interval, and applying the at-speed current to the spindle motor until the spindle control current is updated.

3. The disk drive as recited in claim 1, wherein the disk controller for calibrating a default at-speed current corresponding to a substantially zero BEMF speed error.

4. The disk drive as recited in claim 1, further comprising a wedge time counter incremented at a predetermined frequency, wherein the disk controller for accumulating wedge time counter values representing a predetermined number of wedge-to-wedge times to generate the wedge time period.

5. The disk drive as recited in claim 4, wherein the disk controller does not include the wedge time counter value in the wedge time period if a servo wedge error is detected.

6. The disk drive as recited in claim 5, wherein the servo wedge error includes an inability to synchronize to a servo wedge.

7. The disk drive as recited in claim 5, wherein the servo wedge error includes detecting an invalid track identification value in a servo wedge.

8. The disk drive as recited in claim 5, wherein the servo wedge error includes detecting an invalid wedge time counter value.

9. The disk drive as recited in claim 5, wherein:

(a) the disk controller for calibrating an at-speed current corresponding to a substantially zero wedge speed error; and

(b) if the disk controller excludes a predetermined number of wedge time counter values from the wedge time period, a time-out error condition occurs wherein the disk controller for applying the at-speed current to the spindle motor until the spindle control current is updated.

10. The disk drive as recited in claim 9, wherein the time-out error condition subsides after the disk controller successfully accumulates a predetermined number of wedge time counter values and updates the spindle control current.

11. The disk drive as recited in claim 10, wherein if the time-out error condition does not subside within a predetermined failure interval, the disk controller begins controlling the spindle motor in response to the BEMF speed error generated from the BEMF signal.

12. The disk drive as recited in claim 11, wherein the predetermined failure interval equals one revolution of the disk.

13. The disk drive as recited in claim 11, wherein if the disk controller successfully accumulates a predetermined number of wedge time counter values and updates the spindle control current, the disk controller begins controlling the spindle motor in response to the wedge speed error.

14. The disk drive as recited in claim 1, further comprising:

(a) a current modulator for generating a PWM signal representing the spindle control current; and

(b) BEMF detection window circuitry for periodically disabling the PWM signal for a predetermined interval to attenuate noise in the BEMF voltage while the BEMF detector compares the BEMF voltage to the threshold, wherein the disk controller for disabling the BEMF detection window circuitry while updating the spindle control current in response to the wedge speed error.

15. The disk drive as recited in claim 1, wherein the disk controller for:

(a) switching from the wedge spindle speed control mode to the BEMF spindle speed control mode; and

(b) during a settle interval between modes, applying an at-speed current to the spindle motor.

16. A method of operating a disk drive, the disk drive comprising a disk having a plurality of tracks, wherein each track comprises a plurality of data sectors and a plurality of servo wedges, a head actuated over the disk, a spindle motor for rotating the disk at an operating speed in response to a spindle control current, the spindle motor comprising a plurality of windings which generate a back electromotive force (BEMF) voltage, and a BEMF detector for generating a BEMF signal by comparing the BEMF voltage to a threshold, the method comprising the steps of:

(a) measuring a BEMF speed error responsive to the BEMF signal during a BEMF spindle speed control mode;

(b) updating the spindle control current in response to the BEMF speed error to drive the disk at the operating speed;

(c) measuring a wedge-to-wedge time representing a time period between each servo wedge;

(d) calibrating a reference time period representing an accumulation of a predetermined number of wedge-to-wedge times while the BEMF speed error is substantially zero;

(e) switching to a wedge spindle speed control mode;

(f) measuring a wedge time period representing an accumulation of a predetermined number of wedge-to-wedge times;

(g) generating a wedge speed error representing a difference between the reference time period and the wedge time period; and

(h) maintaining the disk at the operating speed by updating the spindle control current in response to the wedge speed error.

17. The method as recited in claim 16, wherein further comprising the steps of:

(a) calibrating an at-speed current corresponding to a substantially zero wedge speed error; and

(b) detecting a time-out error condition if the spindle control current is not updated within

a time-out interval, and applying the at-speed current to the spindle motor until the spindle control current is updated.

18. The method as recited in claim 16, further comprising the step of calibrating a default at-speed current corresponding to a substantially zero BEMF speed error.

19. The method as recited in claim 16, further comprising the steps of:

(a) incrementing a wedge time counter at a predetermined frequency; and

(b) accumulating wedge time counter values representing a predetermined number of wedge-to-wedge times to generate the wedge time period.

20. The method as recited in claim 19, further comprising the step of excluding the wedge time counter value from the wedge time period if a servo wedge error is detected.

21. The method as recited in claim 20, wherein the servo wedge error includes an inability to synchronize to a servo wedge.

22. The method as recited in claim 20, wherein the servo wedge error includes detecting an invalid track identification value in a servo wedge.

23. The method as recited in claim 20, wherein the servo wedge error includes detecting an invalid wedge time counter value.

24. The method as recited in claim 20, further comprising the steps of:

(a) calibrating an at-speed current corresponding to a substantially zero wedge speed error; and

(b) if a predetermined number of wedge time counter values are excluded from the wedge time period, a time-out error condition occurs wherein the at-speed current is applied to the spindle motor until the spindle control current is updated.

25. The method as recited in claim 24, wherein the time-out error condition subsides after successfully accumulating a predetermined number of wedge time counter values and updating the spindle control current.

26. The method as recited in claim 25, wherein if the time-out error condition does not subside within a predetermined failure interval, further comprising the step of controlling the spindle motor in response to the BEMF speed error generated from the BEMF signal.

27. The method as recited in claim 26, wherein the predetermined failure interval equals one revolution of the disk.

28. The method as recited in claim 26, wherein if a predetermined number of wedge time counter values are successfully accumulated and the spindle control current updated, the further comprising the step of controlling the spindle motor in response to the wedge speed error.

29. The method as recited in claim 16, further comprising the steps of:
(a) generating a PWM signal representing the spindle control current;
(b) periodically disabling the PWM signal during a BEMF detection window to attenuate noise in the BEMF voltage while the BEMF detector compares the BEMF voltage to the threshold; and
(c) disabling the BEMF detection window while updating the spindle control current in response to the wedge speed error.

30. The method as recited in claim 16, further comprising the steps of:
(a) switching from the wedge spindle speed control mode to the BEMF spindle speed control mode; and
(b) during a settle interval between modes, applying an at-speed current to the spindle motor.